

MID-INFRARED STUDY OF STONES FROM THE SUTTER'S MILL METEORITE.

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Introduction: The Sutter's Mill meteorite fell in northern California on April 22, 2012, and numerous pieces have been recovered and studied with several analytical techniques [1]. We present a Fourier-transform infrared (FTIR) spectroscopy analysis of fragments from several stones of the meteorite.

Methods and analysis: Infrared spectra of samples SM2 and SM12 were recorded with a Nicolet iN10 MX FTIR microscope in the mid-IR range ($4000\text{--}650\text{ cm}^{-1}$; spectral resolution 4 cm^{-1}), while samples SM20 and SM30 were analyzed with a synchrotron-based Nicolet Continuum IR microscope in the same range. Samples were deposited on a clean glass slide, crushed with either a stainless steel roller tool or between 2 slides, and placed directly on the focal plane of the microscopes.

Results: IR spectra of non-fusion crust samples show several absorption features associated with minerals such as olivines, phyllosilicates, carbonates (calcite and dolomite), and pyroxenes, as well as organics [2]. The carbonates display a main, broad band centered at 1433 cm^{-1} , with additional bands at 2515 cm^{-1} , 1797 cm^{-1} , 882 cm^{-1} , and 715 cm^{-1} . Features associated with phyllosilicates include a symmetric Si–O stretching mode band centered at 1011 cm^{-1} and several O–H stretching mode bands—a broad band centered at 3415 cm^{-1} that is probably due to adsorbed H_2O , and occasionally a much weaker, narrower feature centered near 3680 cm^{-1} due to structural O–H.

Features observed in the $2985\text{--}2855\text{ cm}^{-1}$ range suggest the presence of aliphatic $-\text{CH}_3$ and $-\text{CH}_2-$ groups. However, some of these bands show unusual relative intensities, mainly because of carbonate overtone bands that fall in the same spectral range, which can make the identification of C–H stretching bands problematic. The positions and relative strengths of the aliphatic $-\text{CH}_2-$ and $-\text{CH}_3$ features, where they can be distinguished from overlapping carbonate bands, are consistent with those in interplanetary dust particles (IDPs) and Murchison. Finally, the absence of a strong C=O absorption feature near 1700 cm^{-1} distinguishes the organics in the Sutter's Mill meteorite from that in most IDPs and in Murchison, but is consistent with the organic matter in Tagish Lake.

References: [1] Jenniskens P. et al. 2012. *Science* 338:1583–1587. [2] Nuevo M. et al. 2013. *Meteorit. Planet. Sci.*, submitted.